



# Faculté des sciences appliquées

**FSA**

MECA2324 **Transfert de chaleur et de masse**

[30h+22.5h exercises] 5 credits

This course is taught in the 2nd semester

**Teacher(s):** Miltiadis Papalexandris  
**Language:** french  
**Level:** 2nd cycle course

## Aims

- Advanced study of the fundamental transport phenomena.
- Provide the necessary theoretical background to enhance the student's ability to independently study transport phenomena.
- Description of the essential aspects of heat and mass transfer for industrial practice.

## Main themes

Advanced study of the three types of heat transfer: conduction, free and forced, convection, radiation. Advanced study of mass transfer. Presentation and analysis of heat exchangers.

## Content and teaching methods

- General description: Heat conduction and Fourier's law. Ordinary diffusion and Fick's law. Irreversibility of transport phenomena, entropy production. Phenomenological laws.
- Convection: Phenomenology of convection. Boundary layer near a vertical plane. Transition to turbulence. Other configurations of external flows. Long and short vertical gutters. Wall heating.
- Thermal Radiation: Basic characteristics. Directional effects. Properties of real surfaces. Radiation in absorbing, emissive, and dispersing materials. Semi-transparent materials. Methods of calculations. Practical calculations for containers of non-luminous gases. Radiation of flames.
- Heat exchangers: Basic relations. Calculation of the global coefficient of heat transfer. Calculation of heat losses. Water rings. Efficiency of recuperation and efficiency of the exchanger. Q-T diagrams. Simultaneous transfer of heat and mass: exchanger with partial vapor condensation, atmospheric refrigerants.

## Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

- Prerequisites :  
The two courses of Fluid Mechanics, MECA2321 and MECA2322
- Practical Studies :  
The practical studies consist of of certain exercises and seminar series. The seminars will be devoted to the presentation and analysis of recently published papers.
- Bibliographical references :
  - R. Siegel, J.R. Howell, "Thermal radiation heat transfer", Mc Graw-Hill, 1981
  - A. Bejan "Heat transfer", J. Wiley, 1993
  - J. Taine, J.P. Petit "Heat transfer", Prentice Hall, 1993
  - R.B. Bird, W.E. Stewart, E.N. Lightfoot, "Transport Phenomena", Wiley int. ed., 1960.

**Other credits in programs**

<b>ELME22/E</b>	Deuxième année du programme conduisant au grade d'ingénieur civil électro-mécanicien (énergie)	(5 credits)
<b>ELME23/E</b>	Troisième année du programme conduisant au grade d'ingénieur civil électro-mécanicien (énergie)	(5 credits)
<b>INCH23</b>	Troisième année du programme conduisant au grade d'ingénieur civil chimiste	(5 credits)
<b>MECA22</b>	Deuxième année du programme conduisant au grade d'ingénieur civil mécanicien	(5 credits)
<b>MECA23</b>	Troisième année du programme conduisant au grade d'ingénieur civil mécanicien	(5 credits)